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NORTHWESTERN ELECTRIC COMPANY'S SYSTEM.
BY B. C. CONDIT.

REPORT OF LOS ANGELES DISTRIBUTION SYSTEM
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SUGGESTED CO-OPERATIVE PLAN.
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THE PITOT TUBE FOR MEASURING WATER.
BY BEN D. MOSES.

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VOLUME XXXI SAN FRANCISCO, DECEMBER 6, 1913 NUMBER 23

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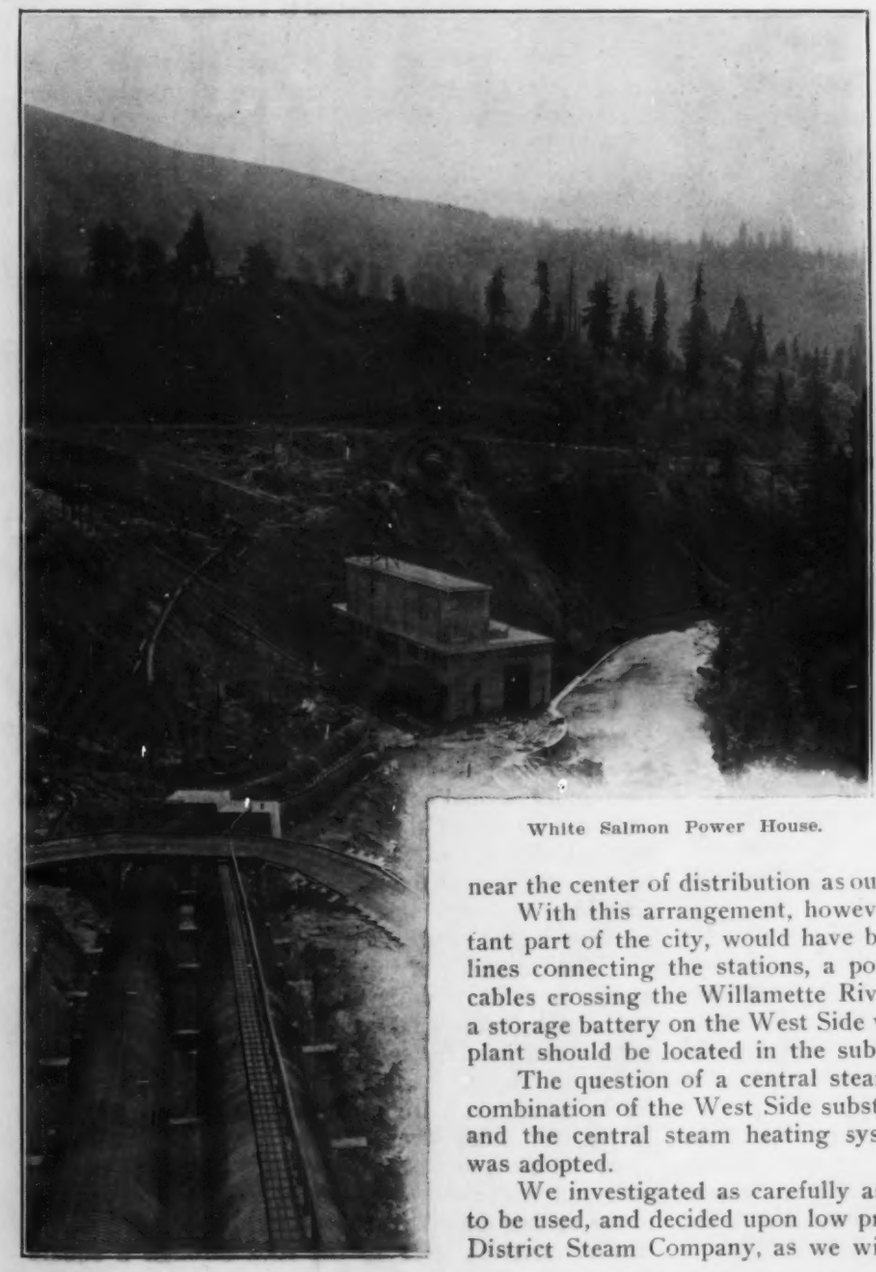
NORTHWESTERN ELECTRIC COMPANY'S SYSTEM.

BY B. C. CONDIT.

(This paper was presented before a Joint Meeting of the local sections of the A. I. E. E. and N. E. L. A. at Portland, Oregon. The author, who is the chief engineer of the Northwestern Electric Company, describes the company's system in that city.—The Editors).



White Salmon Power House.

When the Northwestern Electric Company first decided to enter Portland we gave quite careful consideration to the system of distribution to be used, and finally decided to follow as nearly as possible that of the Portland Railway, Light & Power Company, a uniform system being very desirable.

We have, therefore, alternating current in all of our overhead distribution, using 11,000 volts, 3-phase delta for tie lines and outlying districts, this being again transformed to 2400 volts, both 3-phase and single-phase, for general distribution. In the underground district we are using 3-wire, 120-240 volts, direct current exclusively.

As we then had but one source of supply, the White Salmon River, 70 miles distant, it was necessary for us to consider an auxiliary source, and we first proposed a combined steam plant and main step-down substation on the East Side of the Willamette River, on Albina avenue, this being as near the center of distribution as our high tension line could be brought.

With this arrangement, however, the West Side and most important part of the city, would have been entirely dependent upon the tie lines connecting the stations, a portion of which would be submarine cables crossing the Willamette River, and we therefore felt that either a storage battery on the West Side would be necessary or that the steam plant should be located in the substation on the West Side.

The question of a central steam heating system arose, and as the combination of the West Side substation with the auxiliary steam plant and the central steam heating system offered many advantages, this was adopted.

We investigated as carefully as possible the steam heating system to be used, and decided upon low pressure, as installed by the American District Steam Company, as we wished to use exhaust steam, and the

American District system we felt was most desirable under these conditions.

Our present installation, therefore, consists of:

A main substation called the "Albina Station," at Albina and Loring streets, on the East Side, where power is received from our hydroelectric plant at 3-phase, 60 cycle, 60,000 volts, and transformed to both 11,000 and 2400 volts for distribution.

The "Pittock Station," located in the basement of the Pittock Building, on the West Side, where is combined the a.c. transformation from 11,000 to 2400 volts, and its distribution, the d.c. generating and distribution, the auxiliary steam plant, and the distribution of the exhaust steam for heating.

The Albina station is a three-story concrete structure. On the first floor is located the controlling switchboard, remote control 2400 volt circuit breakers, storage battery for operating the circuit breakers, four 2000 k.v.a. transformers, 60,000/11,000 volt, and three 500 k.v.a. transformers, 11,000/2400 volts.

White Salmon River Development—Dam Looking N. E.

On the second floor is located the remote control 11,000 volt circuit breakers. On the top floor the 60,000 volt switches and aluminum cell lightning arresters.

Each transformer is located in a concrete fireproof cell. All switches in the station are electrically operated, remote control, and are handled from one switchboard.

The tie line between the Albina and Pittock Stations includes a submarine 13,000 volt, 3 conductor, No. 4/0 cable, which is installed with a messenger cable, this being a 1 in. steel cable, securely anchored, to which the main cable is secured. This method is patented by A. J. Pahl of San Francisco, and this is the first use of it in the Northwest.

At the time we were planning our system the Pittock Block, Inc., decided to build an office building covering the entire Pittock Block, 200 ft. square, and in this building we arranged to install our West Side station.

The Pittock Building is a reinforced concrete structure designed for eight stories over the entire block, although only one-half of the building is now being constructed to the full height. In the base-

The Pittock Station in Portland.

ment of this building, and entirely below the street level, we are installing an auxiliary steam plant, our a.c. transformers and distribution board for the West Side, and our d.c. generating station and distribution board for the underground district.

The a.c. distribution system is the same as on the East Side, the power being brought from the Albina Station at 11,000 volts to the switchboard, a portion of it distributed at this voltage to the outlying districts, and a portion transformed to 2400 volts through three 15 k.v.a. transformers, for all distribution within reach of the station.

The d.c. apparatus consists of 1500 kw. motor generator sets, using three-phase 11,000 volt synchronous motors and 250 volt two-wire d.c. generators with balancer sets.

The auxiliary steam plant has 3000 normal h.p. of Stirling boilers, capable of 100 per cent overload, and two 3500 kw. Curtis turbines, generating three-phase current at 2400 volts, which feed directly into the 2400 volt switchboard.

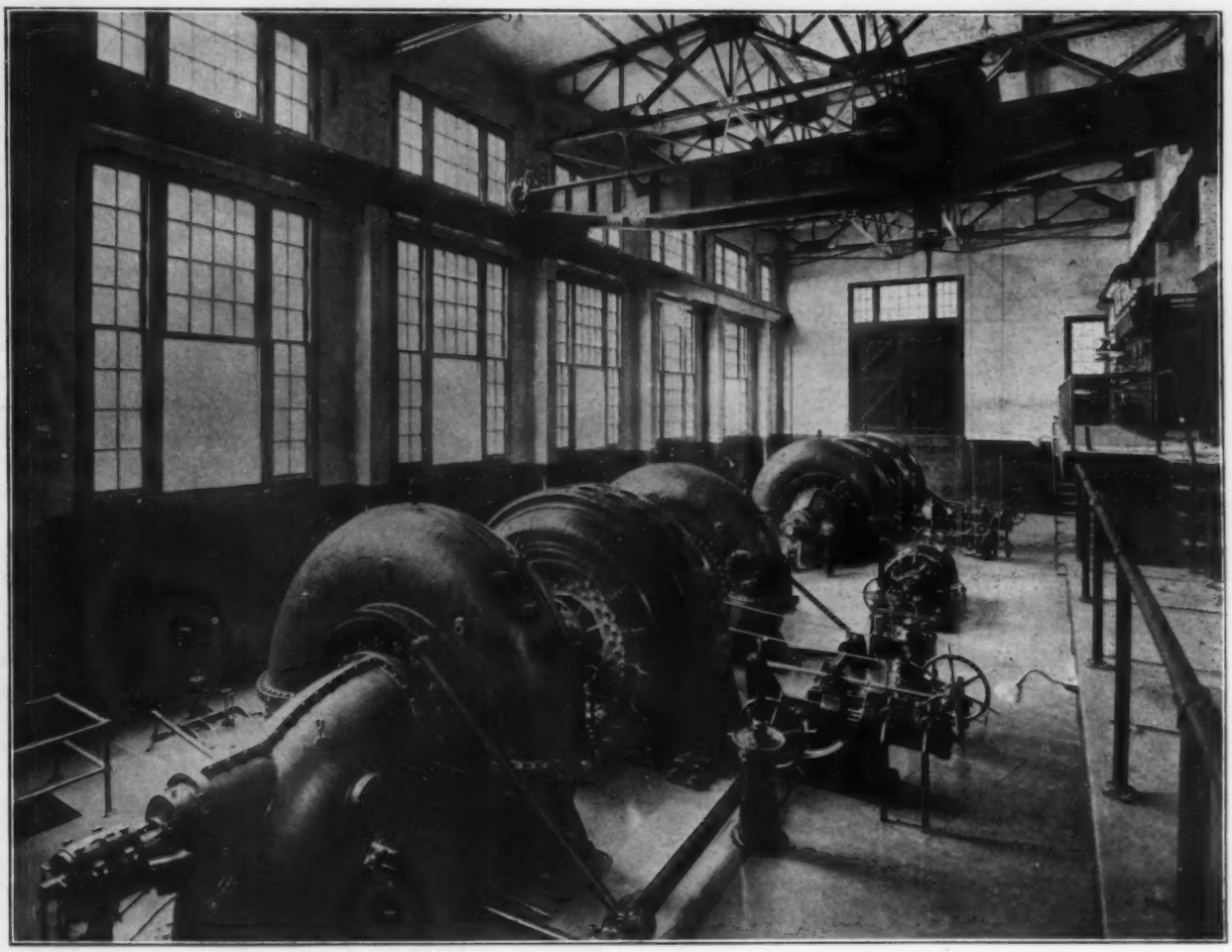
The switchboard is standard practice, all a.c., switches being electrically operated.

As condensing water is expensive and difficult to obtain at the Pittock Station, and as the turbines would be run non-condensing for furnishing steam heat under normal conditions, it was found to be most desirable to install them non-condensing, leaving out the last stages, and this was done, although the turbines are of the steam extraction type, and can at any time have the additional stages added to them and be made standard condensing machines.

The installing of this plant below the street level and in an office building entailed problems somewhat out of the ordinary, these problems being those of ventilation, heat, noise and vibration. Forced ventilation, of course, was necessary and this is provided for by an air shaft from the roof to the turbine room, where two large steam driven fans are installed to force the air into passages over the ceiling of the engine and boiler rooms, and through proper openings in the ceiling for distributing it to all parts as desired. The smokestack goes to the roof through a square

concrete compartment, and the heated air from the engine room, which is not needed for combustion, passes out through this compartment and around the stack. The turbines have a separate air shaft, and draw their own air from above the roof and discharge it into the stack compartment. The synchronous motors are entirely enclosed, and likewise have a separate air shaft from the roof, and draw a portion of their own air direct into the stack compartment. On account of their slow speed they cannot handle enough air when fully loaded, and a small booster fan is necessary for each machine, which by-passes the air duct.

The motor generators being of very slow speed no trouble was anticipated from them, but under favorable conditions the turbines at 1800 r.p.m. might cause some vibration, although even this was considered by those consulted as being exceedingly unlikely. In order to take all possible precautions, however, we decided to install the turbines and the motor generators on a massive concrete block which would be of sufficient size and weight to practically kill any slight vibrations, and to keep this block entirely separated from the building, at least until the matter was thoroughly tested.



Interior White Salmon Power House.

Forcing the fresh air used over the ceiling takes care of the heat, which might otherwise be annoying to the occupants above, but a double ceiling above this air space provides still further insulation.

Noise has been eliminated as far as possible by the entire enclosing of all apparatus except the d.c. generators, and the same insulation that cares for the heat also deadens the remaining noise.

Vibration was the point most to be considered, especially as the first design included a high grade theatre in the building, and it was possible for vibrations to cause a slight hum which would be undesirable in a theatre although not noticeable in any other case. The theatre was later abandoned, but the design of the plant was carried out as originally planned.

The bottom part of this foundation block is separated 18 in. from all building footings and walls, and the space is filled with crushed rock, this being the best material to break up any vibration. The building footings adjacent are on the same level as the machinery foundations, both resting on cemented gravel. The top of the foundation has a 3 in. clear opening around it.

The foundation is about 25 ft. wide, 130 ft. long by 12 ft. deep. In addition, the axis of the large steam turbines is at right angles to that of the motor generators and exciter, this making the vibrations at right angles to each other, and tending to eliminate both.

In studying the above subject, we gathered all information, and consulted all authorities, possible,

and it is the unanimous opinion that we shall not experience the slightest annoyance from the plant.

The steam heating system is designed to supply 2 lb. pressure to the most remote points, and it is estimated that it will require about 6 to 8 lb. pressure as a maximum at the station.

Two 20 in. pipes lead from the station to the streets, and these reduce in size to as small as 6 in. mains and 2½ in. services.

The steam pipes are pure wrought iron covered with a layer of asbestos paper. These pipes are placed inside of a wooden insulating pipe, the wooden pipe being of the continuous stave type, wound with galvanized iron wire, heavily coated with an asphaltum compound, and lined with a layer of asbestos paper and tin, and is large enough to allow about 1 in. clear space all around the steam pipe. When installed the top of this wooden pipe is in addition covered with a layer of heavy asphaltum roofing paper.

The trench is drained with two lines of tiling and 3 in. of gravel covers the bottom on which the pipe is laid.

Expansion and contraction in the iron pipe is cared for by variators placed every 100 ft. These variators consisting of corrugated copper discs properly mounted in flanges and fittings, and are guaranteed to give perfect service. The method of installing is to entirely enclose them in a brick box laid in concrete and buried, making no provision whatever for either reaching them for repairs or inspection, except through the digging up of the street and tearing out of the brick enclosing work.

Our electric underground distribution is of standard clay ducts laid in concrete, with concrete manholes. Wherever steam pipes and electrical ducts go in the same street they are laid together when possible in order to save expense, care being taken to keep the electric duct as far as possible to one side of the steam pipe and not directly over it, on account of the slight effect of the heat.

The laying of the 20 in. steam pipe with its enclosing wood pipe and variators and a line of some 42 electric ducts means some excessively heavy work, it requiring some trenches as much as 10 ft. wide and 14 ft. deep in order to get past and under other obstructions.

Railway safeguards in England have received considerable attention since the recent terrible disaster at Aisgill on the Midland Railway, which resulted in the loss of many lives, caused by the engineer running past a signal which was set against him. This has inspired the English press to urge the adoption of some mechanical means of safeguard when the human element fails, for it is recognized that accidents occur no matter what care is exercised by individuals. A "detonator placer" has now been installed on some sections of the Midland Railway, where it seemed most needed and it is said that the Aisgill disaster could not have occurred had one of these devises been installed at that point. The "detonator placer," costs about $14.60. It is thought that British legislation may compel all railroads to adopt some such signalling device.

ELECTRIC ADVERTISING.

BY J. HARRY PIEPER.

(The author sets forth the advantages of electrical advertising—show-window lighting and electric signs—and directs attention to the considerations most important to making this form of advertising effective. This paper was presented by Mr. Pieper before the Los Angeles Advertising Club, 1913.—The Editors.)

An admirable ever-ready and forceful medium whereby the merchant can advertise direct to all his prospective customers, is the electric-lighted show-window. It talks straight to the wants of the people. It does more than the printed ad. It holds the article out to you—but out of your reach. That is what starts the desire you never knew you had.

Therefore it is the profit-pulling power of this very show-window that gives value to the prominent corner. The merchant prospers to the degree in which he makes this silent salesman work, and his success is proportional to his attracting the attention and interest of every passer-by, and in impressing the value of the offerings on every possible prospect who comes within range of his window.

The big retail corporations that operate chains of cigar, notion, drug and liquor stores employ experts who do nothing but appraise the value of store and window locations. These experts are sent to look at a certain space; they count the passers-by, note what class of people they are, estimate their buying power. This investigation does not stop at dusk, but continues till midnight.

The proprietors want to know the after-dark value of the display windows.

The system that these big corporations follow should be copied by every retail merchant. Window lighting should not be left to chance—it should be appraised and its value known.

A window display is an advertisement—but instead of telling about the merchant's wares, it shows the actual goods. And every merchant knows the difference; if people did not want to see the goods, if they would be content with a picture and a price, all retail stores would soon give way before the mail-order idea.

And because a window is an ad. it has a set value. One pays one dollar an inch for space in a big daily paper or ten cents an inch for space in a country weekly. The price is based upon value. Is there any more valuable circulation than the evening crowds? Is there any time when the window display stands out as clearly as in brilliant contrast with the night? No! I'll answer that myself, for it is common knowledge.

We all know how light attracts humans no less than moths. And in the evening our eyes are ready for diversion, our minds are open to impression. When the day's work is done, the merchant's "circulation" is in its most receptive state and the cost of reaching these biggest opportunities is simply the cost of window illumination. Without that light the cleverest, most appealing display of goods is wasted after sundown.

The direct benefits of almost any sort of advertising are always more or less intangible. The average man does not stop to think why he buys. He does not realize what influence has attracted his at-

tention and induced the desire. It is a very small percentage who write in and say, "I saw your ad. in The Morning Screamer," and even less often do customers walk in and announce that they crossed the street last night to look at the window display and must have that pair of shoes.

Nevertheless, the ads in the Morning Screamer are selling goods every day, else there would be no ads; and the window displays are making sales every night, as witness the store fronts in any city. The money is not being spent on belief alone.

People like to see the goods themselves, and the desire to possess is one of the strongest of human traits. When we see in a store window a hat or a pair of shoes that look good to us, we think of it a dozen times before bedtime. Next morning we pass that way again and another look does the trick.

It rests largely with the merchant whether his window lighting shall be economical or expensive; whether it shall represent efficient advertising at a low cost of an indifferent display with a big bill for current. It is just as foolish to overlook the saving which may be effected by the proper treatment of the illumination as to disregard the value of displaying the goods after eight o'clock.

If the cost seems high, see if the trouble lies in the lighting equipment or in the window itself. Is all the light being utilized, or does the character of the window make it expensive to light?

Naturally the brightest window on Broadway will require a greater intensity of illumination per square foot of floor surface than the brightest window in a city of ten thousand, where the prevailing standard of illumination is not so exacting. But most depends on the window itself, for the color and finish of the walls, floor and ceiling and the nature of the goods displayed determine the quantity of light required. Dark colors absorb a very large percentage of all the light that falls upon them while light colors reflect light and therefore can be brilliantly illuminated in a window that would look dingy were the walls finished dark and dark goods displayed.

Many merchants believe that an aggressive electric sign is unnecessary in their particular case, because they are well known in the community and hold their trade through good service and the quality of their offering, but what of the newcomers' trade? Who gets that? The census returns show steady and universal growth in population—more men and women in almost every city in the land. In the aggregate they number into the millions. Who gets their business? They are newcomers in the town, without prejudice or preference, susceptible to the most favorable impression.

Then there is the floating population—transients—not traveling salesmen alone, but business men on various errands; men, women and children on vacations; and everyone buys as he goes. Then there are the home people who go out seeking some article in a hurry and ready to buy at the handiest place. The suggestion from a bright sign turns the trick. It has happened to everyone of us a hundred times.

When you walk down the street, it's the window where there is action that grabs your attention as you go by. That's why the sign that moves is a sure investment. Just as the steady burning electric sign works longer and faster than the ordinary painted one, the sign that flashes goes one step further. It is an advance agent, it reaches out and beckons. It catches the eye, not once but again and again. The first glance is fleeting, and you instinctively wait and watch for a good look to see how it works. The instinct of curiosity is in us all.

A great many merchants do not consider the use of a flasher because it increases the first cost of the sign. They overlook the fact that the most important point of cost is the monthly current bill and the most important point of all, the eye-catching power of the display.

The man who buys a sign should decide how much he can afford to pay each month for current, and then buy the biggest flashing effect he can operate within the figures. The value of an electric sign is in its power to compel attention.

There is one thing about electric signs and their operation that all are interested in, and that is the electric flasher, the mechanism that operates all flashing or moving signs. This machine operates so that the individual lamp or group of lamps in a sign are turned on and off by means of brushes coming in contact with metal strips mounted on a cylinder which is made to revolve by a small electric motor. All of the metal strips are connected to one side of the circuit and while the brush is in contact with the strip the circuit is closed to the lamp. Thus it requires as many brushes and strips on the cylinder as there are lamps or groups of lamps that are to be lighted at different intervals in order to give the desired effect.

Electric advertising is safe and sure, because in most cases the electric sign serves a double purpose, that of selling goods and of establishing a location.

To do effective electric advertising need not cost much, but the investment should be in proportion to the "circulation." A sign that is within sight of large numbers of people should be impressive; one that catches the eye of comparatively few may be small. In any case, the idea that the sign is an advertisement should be kept always in mind.

A most effective use of electric advertising has been made by real estate men. In one case, a row of new stores was advertised electrically. The stores fronted a well-traveled car line and the electric ad. caught the eye of every night passenger. It was cheap advertising because hundreds of possible renters saw not only the ad. but they saw the actual goods which the real estate man offered.

The merchant who puts on his store an electric sign that is also an advertisement is getting two profits from one investment. When you see a blaze of light and read the big sign that stands out against the night, the firm name has taken on a positive identity, and the picture lives in your brain to be recalled by the slightest suggestion.

The electric sign is a civic aid and the city with many electric signs is known as a "live town." Every merchant realizes what this means. To some folks the title "live town" may suggest a place where vice is ascendant, but the clear-sighted man of business knows better. It means a town or city where people are abroad in the streets after dark, studying the win-

dow displays, patronizing places of amusement and seeking relaxation from the day's work. In places where folks go to bed with the chickens, I use this word advisedly, the dry-goods merchant, the clothier, the milliner and the haberdasher do a dull business, for nobody cares to dress well unless they can "show off" their clothes. But in cities and towns where the lure of the lights bring people down to town after dark, trade of all sorts is brisk, people learn to spend more freely and the needs of the community are increased.

The city that is bright with light is safer, cleaner, more free from vice. Its people are happier, more progressive and more prosperous. So every electric sign and brightly lighted show window that is added helps not only the merchant but the street upon which it is erected, and the city also. It not only advertises the man whose name it bears, but helps increase property values and to win for the city the name, "A Live Town."

A great many merchants have conceived a prejudice against electric advertising, because they feel that it lacks dignity. But such is not the case. The church and the bank may certainly be looked to for example in dignified deportment. What is the significance of the steadily increasing number of electric signs to be found today on the most stately churches and the most conservative of banks? Modern stone and marble structures that represent the most carefully studied product of the architect are equipped with harmonious electric displays that broaden their influence without the slightest incongruity. The blazing cross on the summit of the church spire or the word "Come" high up on the belfry does not offend the most straight-laced churchman. The name of the bank shining out over the evening streets is simply an extension of that invitation to the public and that courtesy to customers seeking the institution that is freely offered within by officers and clerks alike.

The one electric display sign in Los Angeles owned and operated by a national advertiser, is the one at Fourth and Broadway on the roof of the Grant Building advertising Elgin watches.

This sign was erected by one of the largest outdoor advertising concerns in the country. When I tell you that they sent a corps of experts, headed by an electrical engineer, out here to erect this sign, and you realize the expense entailed by so doing, you can estimate just how valuable the Elgin Watch Company considers electric advertising. There are over 3000 lamps in this sign. The watch face is over six feet in diameter and the clock works stand five feet high, it being necessary to cut through the roof to allow the pendulum to swing.

If electric signs make for a life in the town that is business, let us all get together and work to that end.

Aerial transmission line patrol is a possibility, indicated by the feat of Robert G. Fowler, aviator, accompanied by Electrician Kitto, in paralleling the lines of the Great Western Power Company in an aeroplane. The distance of 68 miles between Brighton and Oroville, California, was made in two hours and eleven minutes.

CLEAN SALESMANSHIP.

BY W. F. WESTBROOK.

(This article should prove of interest to all salesmen. It contains pertinent pointers regarding clean salesmanship in selling electric service, and was presented as a short talk to central station salesmen. Mr. Westbrook is an assitant district agent of the Southern California Edison Company.—The Editors.)

In order to make a better showing we must make friends, and in order to make friends we must work. A good friend is the satisfied consumer, and it makes a good clean salesman to aid in giving that satisfaction—a man who is thoroughly acquainted with his line of work and who can give the people the straight facts and prove it with good service. Our goods will back any arguments, so you need never hesitate to talk a doubting customer into a sale, providing you do so in a clean gentlemanly way. Never misrepresent, for that will be our undoing quicker than anything else.

A satisfied consumer is an asset to any business. It means cheap advertising and a return call when they are in need of anything in your particular line. I know at times you have discussions with prospective customers, and I would listen to their arguments closely, in that way getting a wider view of public opinion, and it will also be a help in answering other people's questions—put you on your guard so to speak—for the wide-awake salesman has a satisfactory answer to all inquiries.

There are two classes of salesmen, one careful, the other careless. The careful salesman is the one that is always looking after the interest of his customer, especially the little details not familiar to the public in general. For instance, when a man is signing an application, if it is new business, call his attention to the fact that the company is not allowed to set the meter until the installation is first inspected and O.K.'d by the city inspector. Very often there is some slight defect in the wiring or fixtures, which holds up the O.K., and if these things are explained thoroughly by the salesman it prevents annoyance and wrong impression. The careless salesman doesn't think the little details worth while, thereby causing ill feeling on the part of the consumer and lots of extra work for the office. This reminds me of what Mr. R. H. Ballard said on Specialization: "This is the day of specialization, no question about it. You see it on all sides. We see the man who specializes coming to the front and getting himself recognized for certain higher positions and advancement. The management is always looking for a man who can do some one thing and do it extra well. We have a great deal of trouble from time to time in finding men who have progressed along their special line so far as to know all about it and be familiar with the subjects that come up daily in the various departments along their particular line. Specialization in the right way will bring you into prominence and make your future brighter than most anything I know."

I might add why not clean salesmanship. There is popular prejudice against all corporations and every man dealing with the public is considered the company.

What we have to do is to instil confidence into our customers and that confidence is gained by square dealing and clean salesmanship.

COST OF SEATTLE STREET LIGHTING.

The municipal lighting plant of the city of Seattle has been exploited throughout the country by officials of the city and the advocates of municipal ownership of public utilities as a shining example of the successful operation of a municipally owned utility. Officials of the city as well as those believing in municipal ownership of public utilities have repeatedly stated that the cost to the taxpayers of Seattle for street lighting had been materially reduced. After almost eight years of operation of the municipal street lighting system, it is interesting to observe how the taxpayer fares.

In order to fully appreciate what the following table discloses, it should be stated that the same series arc lamps with additions of the same kind thereto, purchased from the private company in 1905, are still in use. The series incandescent system is the same except that the more efficient tungsten lamp is used in place of the old carbon lamp. A study of the above table, based upon data taken from the 1911 report of the superintendent of the municipal plant (the last report issued), will reveal at a glance what has happened to the taxpayer.

A Comparison of Costs to the Taxpayer for Street Lighting in Seattle, Washington, Under Private Ownership in 1905 and Municipal Ownership in 1913.

Kind.	c.p.	Watts.	Year.	Line Drop Per Cent.	Watts per Hour.	3970 hrs. per Annum.	Kw.-hr. Rate.	Cost per Lamp.	Increase Municipal Ownership.
Incandescent Carbon	30	106	1905	13.5	123	488	3.07	$15.00	
			1913	13.5	123	488	4.5	21.96	$6.96
Incandescent Carbon	32	80	1905	20.	100	397	3.07	12.19	
			1913	20.	100	397	4.50	17.87	5.68
Incandescent Tungsten	40	50	1905	20.	60	238	3.07	7.31	
			1913	20.	60	238	4.50	10.71	3.40
Incandescent Tungsten*	40	50	1905	13.5	58	230	3.07	7.06	
			1913	13.5	58	230	4.50	10.35	3.29
Arc*		430	1905	13.5	500	1985	3.33	66.00	
			1913	13.5	500	1985	4.50	89.33	23.33

*Series.

It will be noted that the cost to the taxpayers of a series carbon incandescent street lamp in 1913 under muncipal ownership would be $6.96 per annum more than in 1905 when furnished by the private company. Tungsten lamps are, however, being used, and the cost to the taxpayers in 1913 is $3.29 per annum more than if furnished at the rate that current was sold to the city by the private company in 1905. It should be noted that the carbon 6.6 ampere incandescent lamps cost in 1905 more than the present series tungsten lamps used.

In the cluster posts, 32 candlepower, 80 watt lamps are used in many instances; the cost of these lamps to the taxpayers in 1913 is $5.68 per annum more than the taxpayers would have had to pay under the rate charged by the private company in 1905. In other words, the taxpayers were paying the private company in 1905 a rate of 3.07c per kilowatt hour for incandescent lamps used for street lighting as against a rate of 4.5c charged the taxpayers by the municipal plant in 1913. The cost of these lamps was greater in 1905 than the present cost of the same lamps.

In the case of the series arc lamps that are being used by the city in 1913, and which are the same lamps that were used by the private company in 1905 for street lighting, the taxpayer is paying $89.33 per annum for each arc lamp as against a charge of $66.00 per annum by the private company in 1905.

ELECTRIC COOKING—CONSUMPTION AND COST.

BY S. J. HALLS.

(A recent short item on "Electric Cooking at Victoria, B. C., aroused considerable interest on the part of some of our central station readers and further information was asked for. In response to an urgent request, Mr. Halls, manager light and power department, B. C. Electric Ry. Co., who is largely responsible for the popularity of electric cooking at Victoria, hurriedly compiled this article. Further data is promised.—The Editors.)

Interest having been expressed in the wonderful increase in electric cooking at Victoria, B. C., the following information regarding the rates charged and the cost of this service to the consumer has been cheerfully compiled.

We charge a rate of 5 cents per kw.-hr., this being an average of our power rates for the small power customer, subject to a minimum charge of seventy-five cents per connected kw.. This rate has met with universal favor, probably accounted for by the fact that monthly bills are much lower than one would expect.

The accounts of twenty customers selected at random, but representative of the rest, were analyzed. They show a total connected load of 74.5 kw. or an average of 3725 watts per customer, the maximum load being 4.5, and the minimum 2 kw.

From January to June of this year, both months inclusive, their average monthly consumption was 86 kw.-hr. per customer; the highest individual average being 184 kw.-hr. and the lowest 45 kw.-hr. per month; with an average monthly consumption of 23.2 kw.-hr. per connected kw. The lowest amount paid to us during that period, was a bill for $1.75, the minimum charge on a small connected load and the highest, $12.45, the load being 4.5 kw.

On account of the minimum charge made the average price over the period and for the customers considered was 5.44 cents per kw.-hr. The highest earnings per month per connected kw. is $3.00 on a load of 2 kw., and the lowest 65 cents on a connected load of 4.5 kw.; the average earnings per connected kw. being $1.26 per month. The smaller connected loads show the best average earnings.

There seems to be but little influence of the seasons upon the current consumption. The highest monthly total was in January, the next highest in June and the lowest in May, although February, being a short month was not less than the average.

The average kilowatt hour consumption per customer by months was as follows:

Month. 1913.	Ave. Consumption kw.-hr.
January	97.
February	80.
March	87.
April	82.
May	79.
June	90.

THE PITOT TUBE FOR MEASURING WATER.

BY BEN D. MOSES.

It has been found experimentally that the velocity of water in a pipe varies at different distances from the center. At the center it is higher than at the boundaries.

In the study of the comparative velocities let us consider all the particles of water in the plane EF Fig. 1, normal to the pipes axis and examine their behavior during flow. These particles would for perfect axial flow proceed to arrange themselves in a hemispherical shaped surface which as time goes on becomes sharper and sharper at the axis. (See Fig. I, abc).

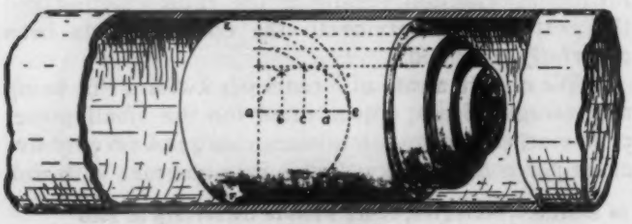


Fig. 1. Showing the Pipe Method of Considering the Water Flowing Through Circular Tubes, and Geometrical Method of Sub-division Into Equal Sectional Areas.

Now assume that this flow is purely axial and that there is no cross flow, eddying nor whirling, and too, that the water stream behaves as a series of concentric annular cylinders flowing one within the other, their respective speeds increasing as they are located nearer the axis of pipe, each cylinder moves as a rigid pipe. The greater the number of divisions into these pipes, the nearer is the approximation to the true state.

Let the distance through which any ring, whose cross-sectional area A, move in one second, be y. The volume $A \times y = Q$ is then the quantity in cu. ft. per sec. represented by the particular "pipe" chosen.

The volume for each pipe being its cross-sectional area multiplied by its velocity, the total volume is the sum of the volumes of all these pipes, or

$$Q \text{ total} = (A_1y_1 + A_2y_2 + A_3y_3 + \ldots\ldots\ldots\ldots\ldots A_ny_n)$$

if, however, the areas are all the same or

$$A_1 = A_2 = A_3 = A_4 = \ldots\ldots\ldots A_n$$

the expression reduces to

$$Q = A\,(y_1 + y_2 + y_3 + \ldots\ldots\ldots y_n)$$

This condition can be very easily satisfied geometrically as follows (See Fig. 3): A semi-circle is described on abcde, the radius of the pipe, which is divided into as many parts as there are areas required, r_1, r_2, r_3, etc., will then be the respective radii since $r_1^2 = ab \times ae$; $r_2^2 = ac \times ae$, etc.; r_1, r_2, etc., being a mean proportional between the opposite side and its subnormal. If $ab = bc = cd$, etc.; the areas A_1, A_2, A_3, etc., will be equal.

The rings A_1, A_2, A_3, etc., represent then the "pipes" of water running each with its uniform velocity, which is very nearly the actual velocity of the center of each ring, shown on diagram as y.

Our subdivision is now complete and all that remains is to obtain the y corresponding to each ring.

The Pitot tube, or any of its modifications actually enables us to enter the tube or pipe and really investigate the velocities at different positions.

Let a bent tube AB, Fig. 2, be inserted into a pipe through a suitable cock, with the nozzle B pointed up stream. For no flow the water will rise in the tube to some point, h such that $h_1 = p/w$, where h is expressed in feet and p is the pressure

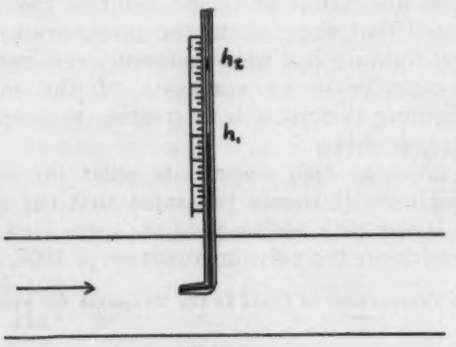


Fig. 2.

in pounds per sq. ft., while w is the density of water per cu. ft. Now let there be some flow in the pipe in the direction V. The nozzle has acting upon it, in addition to the static pressure, the additional pressure due to the velocity of the flowing water and the water will rise in the tube approximately h_1 + the velocity head. This last is proportional to the expression $\frac{v^2}{2g}$ and might be taken as $K\frac{v^2}{2g}$ and the surface will now read h_2 and the difference $h_2 - h_1$ will be a measure of velocity or $= \frac{Kv^2}{2g}$. Finally if two tubes be placed on the same scale with one nozzle with, and one against the stream, the difference $h_2 - h_1$ will be greater than for the single nozzle, but will still be a measure of v or

$V = C\sqrt{2gh}$ where C is some coefficient and h is the difference between the two levels in the tubes.

From the V taken at various points in pipe, the velocity position curve can be plotted and, from the construction show in Fig. 3, the average square roots of the velocity head for each pipe obtained, and by substitution in the following equation, which is substantially the same as Equation No. 1.

$$Q = \frac{A}{h} \times C\sqrt{2g}\,(\sqrt{2g} + \sqrt{h_2} + \sqrt{h_3} + \sqrt{h_4} \ldots\ldots\ldots)$$

The quantity Q can be found, provided the constant for the instrument C is known. If, however, we are looking for this constant, as is the laboratory problem, the quantity is actually measured, and the only unknown, C, solved for.

$$C = \frac{nQ}{A\sqrt{2g}\,(\sqrt{h_1} + \sqrt{h_2} + \sqrt{h_3} \ldots\ldots\ldots)}$$

in which Q = cu. ft. per second.

h_1, h_2, h_3, etc. = average values at $(h_2 - h_1)$ taken from the curve, Fig. 3.

C = constant of the instrument.

A = area of the pipe in sq. ft.

n = number of subdivisions.

When once this constant has been found the instrument can be taken into the field and depended upon to a wonderful degree as an efficient method of measuring water flowing in a closed pipe.

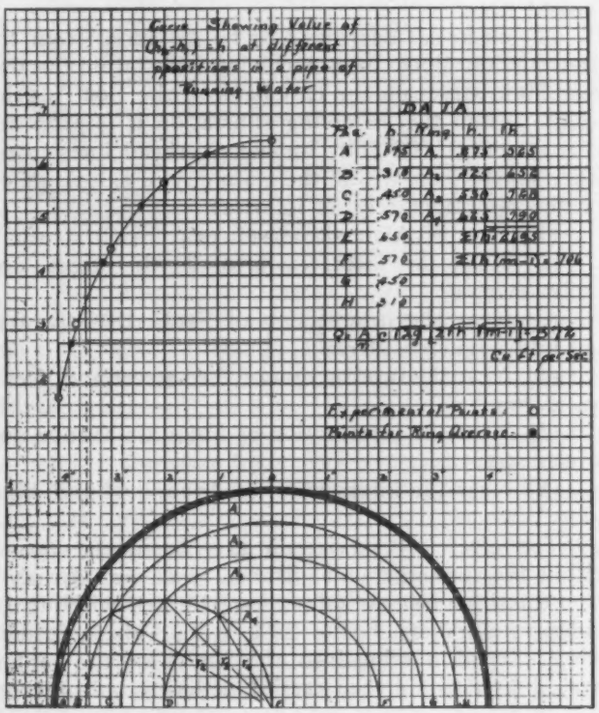


Fig. 3.

Fig. 3 shows the results as worked up from data taken on an 8 in. pipe and the equation for Q is seen to have the term $\sqrt{m-1}$ incorporated. The reason for this, is that carbon tetrachloride, which has a specific gravity of 1.5, was used in the manometer.

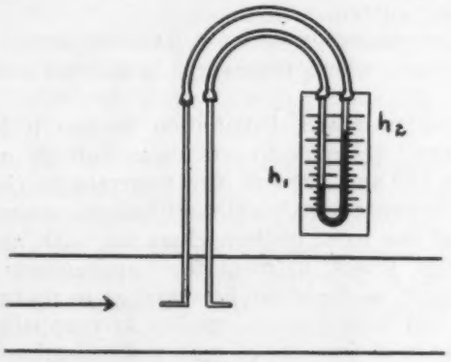


Fig. 4.

If d = weight per cu. ft. of carbon tetrachloride, and w = weight per cu. ft. of water, then, see Fig. 4, by balancing the columns, using AB as a plane of reference, the pressure at A must = that at B for equilibrium

or $(h_2 - h_1) = (h_2 - h_1)\, w + (p_1 - p_2)$

or expressing $p_1 - p_2$ in terms of ft. of water:

$(h_2 - h_1)\, d - (h_2 - h_1)\, w = hw$

$$\text{and } h = (h_2 - h_1)\frac{d}{w} - (h_2 - h_1)$$

but d/w = specific gravity of carbon tetrachloride = m

$$\therefore h = (h_2 - h_1)\, m - (h_2 - h_1)$$

$$\text{or } h = (h_2 - h_1)\,(m - 1)$$

by controlling m of the fluid, it is possible to obtain as sensitive a device as we may desire; for instance, mercury with m of 13.6 would register a difference in heights $(h_2 - h_1)$ of $\frac{1}{m-1} = .0735$ for a difference at nozzles of 1 ft. while carbon tetrachloride would show a difference

$$h_2 - h_1 = \frac{1}{1.5 - 1} = 2$$

or $2 \div .0735 = 27$ times as much.

In conclusion it may be stated that a general study of the velocity curve shows the average for steady flow to vary between .5 and .75, that at the center.

DECISION RENDERED IN POWER SUIT.

A decision that is expected to have a far-reaching effect in determining land title cases in which companies or individuals have made improvements on Federal property without obtaining proper authority from the Secretary of the Interior, has just been rendered by the United States Circuit Court of Appeals in St. Paul. The decision reverses that of Judge John A. Marshall of the United States Court of this district in the case of the United States vs. the Utah Power & Light Company.

The court decides that the power company has no rights to the land it occupies in the Bear River national forest in Cache county, Utah.

Since the suit was brought by United States District Attorney Hiram E. Booth to perpetually enjoin the company from maintaining an alleged unlawful possession of these public lands, the decision would possibly permit the government to confiscate the entire property of the company on the forest reserve.

It is expected that the case will be taken to the Supreme Court of the United States, although officials of the company report that they have not decided on their future action as yet.

The basis of the suit, as recently reported in this journal, is the contention of the Federal Government that companies occupying national forest reserve must obtain permission therefor under the provisions of the act of congress passed in 1896. The company maintains that their occupation of the Federal land was done lawfully under the Forest Land Act of 1866. Judge Marshall held that the property of the power company was not affected by the Act of 1896 because it has been built before the act was passed. The decision of the court of appeals holds that the act of 1896 does affect the property, and that the act of 1866 grants permission only for operations in connection with mining and irrigation and does not apply to electric power plants.

REPORT ON LOS ANGELES DISTRIBUTION SYSTEM.

Letter of Transmittal.

Los Angeles, Cal., Nov. 22, 1913.

The Honorable City Council, Los Angeles, California.

Gentlemen:—In accordance with your instructions as set forth in the contract between the City of Los Angeles and the undersigned, under date of November 11, 1913, which were as follows:

To examine and report in writing to the city council of Los Angeles.

(a) The cost of installing a distribution system such as would be appropriate for taking care of all electrical service within the city, exclusive of railways;

(b) The annual cost of operation of such a distributing system; and,

(c) An estimate of the annual income which the city would derive from the operation of such a distributing system.

We herewith submit our estimates as follows:

(a) The cost of installing a distributing system such as would be appropriate for taking care of all electrical service within the city, exclusive of railways, as of this date, would be $5,697,635.00.

(b) The annual cost of operation of such a distributing system would be $1,283,716.00.

(c) The annual income which the city would derive under the conditions set forth herewith, from the operation of such a distributing system would be $2,029,000.00.

We beg to state that our estimate is based upon the installation of a distributing system that would cover the city of Los Angeles, making provision for reaching any customer within the present city limits, and adequate to distribute a peak load, measured at the customers meters, of approximately 36,000 horsepower, equivalent to 26,860 kilowatts, which was the peak load of all electrical service within the city, exclusive of railways, in October, 1913.

The estimate of the annual income which the city would derive from the operation of such electrical distributing system is based upon the assumption that approximately 80,000,000 kilowatt hours would be delivered to customers' meters and sold at an average rate of $.033 per kilowatt hour, which assumption means that the city, through this distributing system, would supply approximately all of the present electrical service required within the city of Los Angeles, exclusive of railways.

The average rate of $.033 per kilowatt hour of electrical energy delivered to customers' meters has been determined from the figures of gross receipts furnished to the board of public utilities by the three operating companies from their records for the year 1913, under a maximum base rate of six cents per kilowatt hour, and upon the assumption, however, that the maximum base rate to be charged by the city per kilowatt hour would be five cents and the average rate for electrical service to customers reduced in the same proportion.

C. L. Cory G. L. Hoxie C. W. Koiner
Consulting Engineers.

Cost of Installing Distribution System.

In estimating the cost of installing an electrical distribution system, as set forth in detail below, we have assumed that it will be appropriate to meet the requirements of providing all electrical service within the city, exclusive of railways, the peak load, aggregate number of customers and total consumption in kilowatt hours to be practically that required at the present time.

All electrical energy is to be delivered from the transmission lines to a receiving substation located near Main street on the east bank of the Los Angeles River. From this receiving substation it is proposed to construct 33,000 volt, 3-phase overhead lines to six other substations, within the main city of Los Angeles, located approximately as follows:

(1) East of Alameda street, near Sixth street;

(2) Near the intersection of Sixth street and Union avenue;

(3) Near the intersection of Santa Barbara avenue and Figueroa street;

(4) Near the intersection of Pico street and Western avenue;

(5) Near the intersection of Fountain avenue and Gower street;

(6) Near the intersection of Avenue 64 and Marmion Way.

The electrical service in the business section, within the underground district, will be furnished from the three nearest substations, located without the underground district, the 2200 volt, 3-phase feeders being carried overhead to the limits of the underground district and then carried underground to transformer vaults conveniently located. Service to San Pedro is provided by a 3-phase, 33,000 volt overhead line, terminating in a substation there located.

In the various substations the necessary step-down transformers and auxiliary apparatus are provided, so that alternating current may be delivered at 2200 volt, 3-phase to distribution transformers, from which power will be furnished at 110 and 220 volts alternating current.

Motor generator sets for 500 volt direct service are provided, where necessary, in the different substations.

In the proposed distribution system it has not been deemed desirable to provide an entirely new and extensive 110 and 220 volt direct current service.

The proposed electrical distribution system which will be of the most modern character with minimum distribution losses, to meet the requirements of the present time, so designed, however, as to make its extension and enlargement readily accomplished, and the estimate of the cost of such a distribution system should not be confused with the existing electrical distribution systems which have necessarily been built piecemeal, coincident with the exceedingly rapid growth of the city during the past twenty years, and the original cost, or cost of reproduction new, of the present distribution systems.

Annual Cost of Operation.

From data on file at the board of public utilities of Los Angeles, for the year 1912, which data includes the total kilowatt hours of electrical energy sold to

consumers within the city of Los Angeles and also the annual cost of distributing this power, including distribution expense and general expense, it has been determined that the probable annual cost of distributing all of the electrical power required at the present time, exclusive of railways, will be approximately $600,000 per annum.

In addition the fixed charges upon the total investment in the distribution system, which include interest on bonds, depreciation, obsolescence and sinking fund, have been placed by us at 12 per cent of the estimated cost of the system, or $683,715.00.

The total annual cost of operating such a distribution system, therefore, including maintenance and operation, general expense, and fixed charges, would be $1,283,716.00.

Estimated Annual Income.

The annual income from the sale of electrical energy in the city of Los Angeles will naturally depend upon the total amount of power which can be sold and the average rate per kilowatt hour paid by consumers. From the records placed at our disposal by the board of public utilities, on a maximum base rate of six cents per kilowatt hour, the average price paid by consumers for electrical energy in Los Angeles for the elapsed portion of the year 1913, exclusive of railways, was $.0396. On a base rate of five cents per kilowatt hour, and assuming that the average price paid by consumers would be in the ratio of five-sixths of what was actually paid by such consumers during that portion of the year 1913 which has passed, the average return per kilowatt hour would be $.033. If a total of 80,000,000 kilowatt hours were delivered and sold to customers' meters at this rate, the gross revenue would be $2,640,000.

In order to provide for losses between the receiving substation and customers meters, the committee has estimated that a delivery of approximately 94,000,000 kilowatt hours would be required at the receiving substation in Los Angeles, at the end of the transmission lines. Crediting the generation and transmission system with 94,000,000 kilowatt hours per year at a unit price of $.0065 the cost of the electrical energy delivered to the receiving substation would be $611,000.

The annual income, therefore, which the city would derive as the result of the operation of a distribution system would be represented by the gross revenue from current sold to consumers, reduced by the cost of electrical energy delivered to the receiving substation. Assuming that 80,000,000 kilowatt hours were delivered and sold to customers, the resulting annual income from the distribution of electrical energy would be $2,029,000.

Estimate of Cost of Electric Distributing System for Los Angeles,

November, 1913.

Underground Systems—		
700,000 duct feet of duct at 30c	$210,000	
550 manholes at $100	55,000	
150 transformer vaults at $250	37,500	
Primary Cables—		
212,000 lb. T. B. W. P. wire at 20½c	43,460	
60,000 ft. 3 cond. lead at 56c	33,600	
28,000 ft. 3 cond. lead at 25.2c	7,056	
Secondary Cables—		
155,000 ft. No. 4/0 Duplex at 48.8c	75,640	
70,000 ft. No. 1 Duplex at 27.1c	18,970	
55,000 ft. No. 1/0 Single at 17.6c	9,680	
35,000 ft. No. 4	3,920	
Ornamental Lighting—		
Services and Connections—		
3,284 services with one extension each at $82.83	272,014	$847,840.00
Overhead—		
33,000 Volt Feeders to substations, 219,500 lb. No. 0 at 20.5c	44,998	
800 double pole tops)		
600 single pole tops)	9,500	
Primary and Secondary Copper—		
2,470,000 lb. at 20.5c	506,350	
Poles—		
35,000 at $17.75	621,250	
105,000 cross arms at $1.17	122,850	
5,000 guys at $2.50	12,500	1,317,448.00
Transformers, Services, Etc.—		
Transformers—28,000 kw. at $9.60	268,800	
Grounding 3700 transformers, at $4.00	14,800	
Service Connections—57,684 at $7.00	403,788	
Meters—90,000 at $9.00	810,000	
Arc Lamps—3757 at $33.50	125,860	
1110 miles No. 6 wire at 21c per lb.	137,529	
Incandescent street lighting	10,600	1,771,377.00
Transmission and Distribution to San Pedro—		
2200 poles at $16.00	35,200	
200 33,000 volt double circuit pole tops at $8.60	6,880	
4400 cross arms at $1.17	5,148	
220 guys at $2.50	550	
120 miles No. 0—202,560 lb., at 20.5c	41,525	
2200 volt primaries, 50,280 lb. at 20.5	10,307	
Secondaries—43,725 lb., at 20.5c	8,964	108,574.00
Substations—		
27,220 kw. at $15.00	408,300	408,300.00
Operating Expense—		
Buildings, real estate warehouse and testing department	55,000	
Machine shop, equipment and winding room	15,000	
Laboratory and testing equipment	5,000	
Office equipment	15,000	
Stock	60,000	
Stable, equipment, automobile, garage and real estate	100,000	
Pole yard and equipment	15,000	265,000.00
Total		$4,718,539.00
Engineering, superintendence, etc., 7½ per cent		353,890.00
Contingencies, 7½ per cent		353,890.00
		$5,426,319.00
Interest, 5 per cent for one year		271,316.00
Grand Total		$5,697,635.00

SUGGESTED CO-OPERATIVE PLAN.

BY R. H. BALLARD.

(Mr. Ballard, secretary and assistant general manager of the Southern California Edison Company, clearly analyzes the report recently submitted to the city of Los Angeles advocating the municipal construction of a municipal distributing system for aqueduct power. He brings forth the advantages of co-operation between the city and the corporation and shows the dangers of competition. His masterly presentation is worthy of careful study.—The Editors.)

Co-operation is the word of the hour. It is in the mouth of the laboring man, merchant, manufacturer and banker. In the past 20 years we have laid the foundation of our southwestern empire, and the completion of the Panama Canal gives us our opportunity to make this empire the home of an enormous population of thrifty people. To accomplish the destiny which we all believe is ours, we need money and we need credit. There are great ranches to be turned into intensive farms of the thrifty agricultural class; there are factories to be built to turn our raw materials into finished products; the city is urgently in need of water main extensions, storm drains, schools, parks, municipal buildings and tunnels, and our property owners are protesting vigorously against the continuance of the assessment plan to raise funds for such purposes. Any movement, public or private, which will destroy or lessen the earning power of the money already invested in securities of Southern California tends to shut the door of credit against us.

Truly the time has come when co-operation is a necessity, and a real achievement along this line will be a working basis upon which public service corporations and the people's representatives in city govern-

ment can work shoulder to shoulder in all things for the greatest possible development. Can the corporations be assured that they will not be made the football of politics? Can the people be assured that the rights and privileges granted by them will not be abused by the corporations? For the answer to this last question, we need but call to mind the state constitution and laws which confer upon the people's representatives in state and city governments complete regulation of public service corporations. Take the state railroad commission, for instance. Its powers take from public service corporations their financial and many of their executive functions, bringing them in reality to the position of public servants. You may know that no California public service corporation can issue or sell one dollar's worth of stock unless the right to issue such stock is authorized by the state railroad commission. The commission names the price at which the stock may be sold, and the purposes for which the funds may be expended. It makes a rigid inspection and valuation of properties, and says whether or not the proposed expenditures are necessary. It prescribes a system of accounting and prohibits the use of any books or records not specified in this system. It precludes the issuance of what is commonly known as "watered" stock. This has passed and will soon be so far reminiscent as to take its place with vigilantes committees, the picturesque cowboy and all that went with an earlier civilization.

Regulation of rates by the state railroad commission and other regulating bodies eliminates the possibility of excessive or undue profits, as the four fundamental principles of rate regulation are interest on a fair value of the property, depreciation, operating expenses, and volume of business, duplication of property means doubling interest and depreciation and in the long run higher rates to consumers. There is no escape from this. Duplication of the electric distributing systems in Los Angeles would mean an economic waste variously estimated at from $5,500,000 to $9,000,000 or more, which of necessity would increase annually. It would require the setting of approximately 45,000 unnecessary poles and tearing up and replacing more than 400,000 sq. ft. of street paving.

Negotiations are now proceeding between the city of Los Angeles and the electric companies looking to effecting a co-operative arrangement having all the advantages, both to the city and to consumers, of complete municipal ownership, and in addition placing at the city's disposal the services of trained men and experts. The city would deal directly with consumers, collecting all bills in the name of the city, making full use of the city's power distributed direct to consumers, paying the companies only for the use of their systems and for services rendered. The city would secure the entire Los Angeles market, could reduce rates to a 5 cent basis, and have a fixed and certain income from the use of its power of approximately $1,000,000 per year.

At the present time the distributing systems of the companies could not be sold to the city, were the city in position to buy and had its money in hand to pay for them. The properties are subject to various mortgages, securing bonds, which cover not only the distributing systems in Los Angeles, but all of the properties including power plants within and without the city. It is said that time cures all things, and it is our belief that time will cure even this difficult situation. The companies are willing and anxious to do what they legally can to help the situation in this respect, proposing this co-operative arrangement for such period as is necessary to allow them to replace Los Angeles business with other business, to make full use of their generating plants. They promise to take up in good faith with the trustees of the bondholders, the matter of securing releases of their property at that time. Some of the city officials are insisting upon a a definite option at a fixed price and immediate possession and operation by the city. This, I am informed, is not legally possible, but we are working along, trying to arrive at some solution which will preserve the rights of both parties, prevent the unnecessary duplication of property, and replace turmoil with co-operation.

The power distribution report just published might be thought to have important bearing on the present negotiations with the city, unless it is carefully read in full and thoroughly understood. The report sets forth ideal or theoretical conditions, based upon present business and certain assumptions outlined in the instructions to the engineers, which they have fairly made clear to one familiar with the business, though not entirely plain to the layman. It demonstrates the tremendous advantage to the city of securing the entire Los Angeles market, which is the basis of present negotiations.

The estimate of cost of installing the distributing system is made as of the date of the report, whereas the city's power will not be available before the year 1915. Two years' extensions and additions must therefore be considered. In the proposed distributing system, it has not been deemed desirable to provide for 110-220 volt direct current service. This is a very expensive service, now extensively in use and demanded by consumers. It is used in the operation of elevator motors, modern office buildings are specially wired for it, newspapers and printing press motors use it almost exclusively, as do moving picture shows and theaters for spot lighting. The consumers pay an additional charge of 10 per cent for this service.

The addition of the direct current service, extensions and betterments for two years, and suitable provision for extra cost on account of street congestion, would bring the cost of the distributing system considerably in excess of $9,000,000.

The report is based on a peak load measured at consumers' meters, of approximately 36,000 horsepower, which is stated to be equivalent to the October 1913 load. Considering the losses of current which occur in transmission and distribution from the power house to consumers' meters, the power plant must be sufficient to furnish a peak load of approximately 49,000 h.p. to provide 36,000 h.p. at consumers' meters. The capacity of the city's first installation is estimated at 37,500 h.p. peak load provided there is a constant flow equivalent to 10,000 inches of water through the aqueduct, with 20,000 inches during the period of peak load. Power Plant No. 1 therefore would not be suffi-

cient to provide all of this load, even for the month of October, 1913, and the load for December, 1913, will be materially higher, to say nothing of the substantial increase by December, 1915.

The estimate of annual income is based upon the assumption that approximately 80,000,000 kilowatt hours would be delivered to consumers' meters, and the report says "which assumption means that the city through its distributing system would supply approximately all of the electrical service required in the city of Los Angeles, exclusive of railways." This is evidently not intended to represent competitive conditions as records of other cities where competition exists between municipal and private plants show that the municipal plants serve considerably less than 50 per cent of the business.

No provision is made for steam auxiliary plant to insure continuity of service, and as large consumers must in protection to their own business, take service from the source assuring the best service, the difficulties of building up a large business would be thereby increased.

I am satisfied that in competition with the companies, should such an unfortunate condition be brought about, the city would not secure to exceed 25 per cent of the entire Los Angeles business in addition to street lighting, and exclusive of railways, which on the basis of 1915 consumption would give the city a gross income of approximately $1,200,000, assuming the average rate stated in the report. As against this, the annual cost of operating the distributing system is estimated at $1,263,716, to which must be added the annual cost of operating the power plant of about $410,000, or a total of $1,693,716, plus 12 per cent interest and depreciation on added investment necessary to bring the distributing system up to 1915 conditions.

Under competitive conditions, the city would require to accrue 50 per cent of the business to cover cost with no profit.

SOLICITATION—THE KEYNOTE TO EFFICIENCY

BY R. B. MATEER.

(In this article the author emphasizes the necessity for following up central station advertising matter by systematic solicitation if the most satisfactory results are to be secured from advertising appropriations.—The Editor.)

Many public utilities annually appropriate large sums to purchase bulletins issued by various electrical organizations, for distribution among their consumers with a view to encouraging proper electrical equipment and the efficient use of the service supplied. Such a policy, that of placing printed matter at the disposal of a consuming public generally ends all educational work. The average resident consumer is expected to sit down, read the suggestions on illumination or on power applications and promptly telephone in his order if interested or to cast the literature in the scrap basket, if not. Such a policy, literature by mail, may be deemed suitable or in keeping with the utility but it is true that where results are to be obtained conscientious solicitation combined with demonstration is a necessity.

A large and powerful corporation recently contracted for some 50,000 pamphlets on Illumination. It is supposed they were distributed to some fifty thousand consumers and that modern illumination possible with Mazda high efficiency units replaced the blackened carbon lamps—perhaps affecting the consumers bill and to apparently the detriment of the utility and its earning capacity. How effective such a campaign may be is demonstrated by the experience of one, conversant with modern illumination, and who entering a residence found carbon lamps, everywhere in service yet providing but a feeble yellow light.

Astounded and knowing the efficiency of tungsten lamps, these were made a subject of conversation. An interest aroused, a visit was suggested to the local office of the lighting corporation.

A request for tungsten lamps brought out the reply from the counter clerk, "Can't give 'em to you now. They are locked in the safe and I don't have the key. We'll send them up tomorrow."

The precautions to safeguard a few lamps, improved units of illumination, everywhere in use through Pacific Coast states and the delay in promptly delivering the lamps speak for themselves. Of what use is literature, even though read and digested, when any utility fails to encourage through an aggressive policy, demonstration and delivery, the value of the article advertised.

The same amount of money spent in aggressive solicitation by house to house canvas would have resulted in a number of well lighted homes, each a salesman for the local utility. Each home an actual demonstration of a desire on the part of the corporation to grow with the times, living to up-to-date modern and efficient applications of current. Each tungsten lamp properly installed would be a visible token of a co-operative spirit between utility and consumer —yet no policy breathing such a spirit of friendliness on the part of any company can be developed to its fullest extent by the use of postage stamps. Personal solicitation only will mold opinion and develop confidence on the part of the public in quasi-public utilities.

Perhaps such a condition of affairs is due to a lack of knowledge of the character of installations in the home; perhaps it is the result of permitting the consumer to buy "juice" not service; or it may be the result of a narrow policy of business development in employing those who fail to make their company's welfare their own, yet it is a fact that to secure results, solicitation by capable salesmen must go hand in hand with efficient advertising. Each augments the efficiency of the other. Can such a policy as found to exist in an eastern corporation have place long on the Pacific Coast? Why not expend money judiciously in SOLICITATION; establishing and maintaining a comprehensive record of all consumers in your district; records that show the character of the load of each consumer's place of business and home, and by frequent calls upon present consumers and non-users, render your advertising effective?

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Rialto Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

On Library Cars of all Southern Pacific Trains.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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The Electrical Jobber

To the manufacturer reaching out after national business there comes the question of the best manner of marketing his product. There are several methods which might be followed with more or less of success, one which has proven successful in the sale of electrical stock supplies, or shelf-goods, being localized distribution through the electrical jobber. In selling such shelf-goods the way to non-success lies along the road of manufacturers' sales direct to retailer or consumer; first because it costs more and second because his competitors selling through the jobber are able to make a lower price. They are also free to devote their energies to the perfection of product, the extension of markets, and more intensive cultivation of the existing trade.

Waiting for eastern shipments is a prolific source of discontent, discouragement, misunderstanding and loss. The jobber with his local stocks is able to give prompt deliveries with the consequent satisfaction and gain to all.

The retailer who persistently purchases through the jobber is paving the way for further price reductions which this procedure makes possible.

Furthermore a jobbers' corps of salesmen are able to cover the territory with a fine tooth comb. They are able to do this because of the diversity of the lines sold. Their frequent visits also contribute to increased sales as also does their acquaintance with the trade; it is not necessary for them to get to know the trade, a function of the manufacturers' salesman, which often makes deep inroads into the time allowed at each place during the annual visit. From year to year these manufacturers' salesmen are changed and the whole procedure has to be repeated. Considerable business is secured by the jobbers' salesmen because of this thorough covering of the territory which the manufacturers' saleman who is able economically to make only the larger cities, would otherwise lose.

Furthermore, there is the question of credits and accounts. From the East to the Pacific Coast is too long a distance over which to pass on credits—something like an attempt to govern the United States from across the Atlantic—and orders delayed from this cause might often aggravate a Boston tea-party with the manufacturer's goods. In addition to selling, the jobber bears the burden of passing on credits, carrying accounts, and making collections, and with his larger knowledge of local trade conditions together with capital for his purpose and superior facilities has become an economic necessity and the essence of service in the sale of goods electrical.

During the past period of financial stringency those who had unfortunately bought direct from factory realized that a seeming gain might through circumstances be converted into a permanent loss. It pays to buy wisely and conservatively.

The manufacturers, being the first to retrench, could not carry their customers' accounts for any great period and as a result, many of these direct purchasers were forced to the wall. On the other hand, there were many more who purchasing from the jobber were carried up to the extreme limit of their credit.

It is admittedly the province of the manufacturer to find a market for his goods through persistent ad-

vertising, educational work, and missionary endeavor, and if he does this and in addition co-operates with the jobber he will find that success in selling shelf-goods in the West is positively assured.

The Technical Journal

A high class technical journal is not something to be passed up as particularly dry, allowed to age in its wrapper, or opened only to entertain a client. Where such neglect does obtain it is the result of a false concept and not of any failure of the thing itself.

Those who realize all that the technical journal contains for them and the manner in which the knowledge imparted contributes to their efficiency and the advancement of their interests, await each issue with impatience, devour it with avidity and always like Oliver Twist, come back for more.

The race moves forward with rapidity and if you would be an authority—an individual operating at highest efficiency—it is necessary that you too read the record of achievement, which a high class technical journal presents as it occurs. Then when occasion arises your problems will be solved much more readily because of your knowledge of what has been done before.

To be completely satisfied with the technical knowledge you now have is to telegraph ahead your intention not to arrive. To mentally agree to surrender your task for others to complete while you are yet in your prime.

Imagine an engineer who graduated in eighty-two saying that he "subscribed for, but had no time to read the technical magazines." The leading engineers of the day, the men with their fingers on the pulse of mighty projects which their brains originate and carry through to a successful issue, not only read, but usually tear-up one copy of each technical magazine from which articles of especial interest are culled and filed for future reference, while others preserve complete files indexed for easy reference.

"Too busy to read" cramps intellect and limits understanding.

The man who is always busy—that is, busy doing things—certainly learns something. May be getting a good advancing education, but if he concentrates only on this his horizon is limited and the necessity for tackling some other phase might prove a knock-out blow in his professional solar plexus.

The minds of men of many and diverse occupations contribute to the pages of the technical press and so give variety. These men rank high each in his particular specialty and so make the journal an authority and confer upon the readers exceptional educational advantages.

The technical magazine symbolizes technical education.

Technical education is not something for the expert alone. It is for all men engaged in the particular trade, occupation or profession considered and not for the favored few. Articles of all degree therefore find entrance. The art and science are perhaps most prominent but the allied trades and occupations gain also their legitimate place.

New Water Power Bill

What is stated to be a conservative water power bill has been planned by the House committee on interstate and foreign commerce, and is so framed to steer a middle course between the extreme state's-rights supporters and the federalists. It is expected that the bill will be introduced this week.

From long range it appears that this bill is based upon the opinion that public lands should be retained in public ownership and controlled by the federal government. It will therefore open up for thorough and friendly discussion in Congress the facts pertaining to the controversial subject of conservation and the proper determination of state and federal rights. It should tend to eliminate the apparent uncertainty which now exists in connection with water power developments.

Necessary development is urgent at all times, should contain no element of uncertainty, and be always properly protected. The theory of conservation must be harmonized with practical requirements.

The bill contains two major provisions, one of which is that there must be the largest possible use of water on navigable streams and the other relates to the leasing of power. It provides for fifty year leases with renewal privileges and also for protection of properties by the lessee.

It further provides for three classes of charges. These are reimbursement of the government for any expense it may incur, rentals, and costs incident to restoring streams to their former navigability. Under the rental provisions the bill contemplates payment for the use for power purposes of government constructed reservoirs and for the use of government lands utilized for power purposes including forest reserves of the West.

The determination of the position of the government in arriving at charges to lessees for the power generated is to be left to discussion in both houses of Congress. The extreme state's-rights supporters want no charges whatsoever; while the federalists favor liberal charges, first on the ground of their claim that the interstate commerce clause of the constitution will govern where power is transmitted across state borders, and second, the conditions of the contracts under which franchises are granted. These franchises must however be subject to state laws regulating public utilities.

If C. P. Steinmetz's nation-wide transmission system, analogous to our railways, is the vision of a scientific mind in the vanguard of electrical development, then this will, even if only partially realized, result in a considerable increase in interstate commerce in hydroelectric energy sales. With such a development, the federal government must of necessity take an active part as arbiter and harmonizer.

The only true conservation of water powers consists in their complete utilization in the interests of all.

If this new bill serves to stimulate development where present acts of Congress seem to retard them much good will have been accomplished. It is hoped that the outcome will be to this end.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. C. Goldrick, manager Kellogg Switchboard & Supply Company, San Francisco, is at Vancouver, B. C.

J. D. Galloway, consulting civil engineer of San Francisco, has returned after traveling five months in Europe.

Fred Poss, Pacific Coast manager for the Benjamin Electric Manufacturing Company, spent the past week at Los Angeles.

J. M. Kearney, Western Electric specialist, of New York, handling W. N. Mathews' line, arrived in San Francisco the first part of the week.

Garnett Young, manager of the Telephone & Electric Equipment Company, has returned to San Francisco from an extended Eastern trip.

Burnett Goodwin, recently elected Jovian Statesman at Portland, Oregon, expects to hold a big Rejuvenation at Portland in the near future.

H. M. Irwin, assistant to the treasurer of Westinghouse Electric and Manufacturing Company, left the first part of the week for a business trip to Seattle.

Franklin T. Griffith, president of the Portland Railway, Light & Power Company, is expected to return this week from a conference with C. M. Clark at Philadelphia.

Robert A. McKee, chief engineer of the steam turbine department of the Allis-Chalmers Company, is expected on the Pacific Coast in a series of visitations to their various coast offices.

Wynn Meredith, Pacific Coast firm member of Sanderson & Porter, is expected to return to San Francisco this week from Victoria, B. C., his first trip since a recent operation for appendicitis.

Elgin Stoddard, vice-president of Chas. C. Moore & Company, Engineers, has returned to San Francisco from a trip to the northwest, where he visited the Portland and Seattle offices of the company.

F. E. Blake, general manager of the Hawaiian Electric Company, Ltd., Honolulu, after an extended trip through the East, has been spending the last week in San Francisco, and will attend the Del Monte Jobbers' meeting before returning home.

W. S. Greenfield, manager of the H. W. Johns-Manville Company, San Francisco, left during the latter part of the week for an extended business trip through Northern California, accompanied by **W. R. Jones,** manager of the Government Department of the same company.

Kirk W. Eichelberger, from the San Francisco office of Chas. C. Moore & Company, Engineers, has returned to San Francisco after a successful two weeks' trip through the northwest. Mr. Eichelberger is specializing on Smith, Vaile Pumping Machinery, as manufactured by the Platt Iron Works Company.

Ray Fulcher, civil engineer, has returned to the San Francisco office of Sanderson & Porter, after negotiating with the Edmonton, Alberta, city officials relative to their contracting to take a large block of the power which his company contemplates developing in the Rocky Mountains, two hundred and fifty miles distant.

Ross Hartley, manager of the Portland branch, **C. H. Carter** of the Los Angeles branch, and **F. W. Killam** of the Seattle branch of the Pacific States Electric Company, have been in San Francisco for the past week attending a district managers' meeting of their organization, after which they visited the Jobbers' meeting at Del Monte, December 4 to 6.

E. A. Finkbeiner, late of the engineering force of the Platt Iron Works Company, and specializing on water wheels and other hydraulic machinery, has become associated with Chas. C. Moore & Company, Engineers, and will be permanently attached to the Portland office of the company from which point he will look after the hydraulic installations made by this company.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

The regular meeting of the Oregon Electrical Contractors' Association was held at the Portland Commercial Club at 6:30 p. m. on the evening of November 26, 1913. Refreshments were served and the regular routine of business was transacted.

Portland Association, A. S. C. E.

The Portland Association of the members of the American Society of Civil Engineers held their regular meeting on November 24th, and discussed the question of "Quantity Surveys." The meeting was well attended and the discussions were extended.

Portland Sections A. I. E. E. and N. E. L. A.

A meeting of the above associations took place on Tuesday evening, December 2d, at the Hawthorne building, the meeting being presided over by Mr. E. A. West. The subject of the evening, "Recent Regulating Measures Affecting Public Utilities," was presented by Mr. O. B. Coldwell, General Superintendent of the Portland Railway, Light and Power Company; H. R. Wakeman, C. E. Condit, D. F. McGee, W. D. Scott and W. H. Evans took part in the discussion.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club at the Commercial Club Thursday, Wm. M. Scott, superintendent of lines and electric service, was the principal speaker. His subject was "The Reconstruction of the Salt Lake City Distribution System." He outlined the changes and improvements which have been made during the past six years in substituting a feeder and main system of distributions for the old ring distribution system. Fifty club members were present.

Electrical Development League of Alameda County.

The Electrical Development League of Alameda County held its regular monthly meeting at 1:15 p. m. Saturday, November 29th. The following officers were elected for the coming year: George Furniss, Pacific Gas & Electric Company, president; B. B. Hill, inspector, Oakland City Electric Department, first vice-president; P. H. Gribble, Kimball Electric Company, second vice-president; G. G. Drew, Pacific States Electric Company, secretary. The speaker of the day was W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company, who read an inspiring paper on Co-operation. Fifty-five members attended the meeting.

Southern California Jovian Electrical League.

The regular weekly meeting of the Jovian Electrical League of Southern California, was held at Christopher's with an attendance of ninety members, Mr. Chas. H. Carter officiating as chairman. Harry N. Sessions delivered an impromptu talk on "Storage Batteries" and Mr. Ernest Ingold, president of the Los Angeles Ad. Club, gave a talk on "The Law of Attention Hitched Onto an Electric Sign." Mr. Ingold outlined the fundamental principles of the laws of attention as applied to retail advertising, and his speech was thoroughly appreciated and enjoyed by all. Two vaudeville acts kindly furnished by the manager of Pantages Theatre, concluded the program.

Electrical Development and Jovian League.

The regular Tuesday meeting of the Electrical Development and Jovian League of San Francisco on December 2 was held at Fred Solari's Cafe under the Jovian Order,

Statesman A. E. Rowe presiding. The Jovians had provided some excellent entertainers whose presence greatly enlivened the meeting. Reigning Vulcan A. H. Halloran gave a report of the rejuvenation at Stockton. Harry Rice of Cleveland made a stirring address and P. B. Hyde, chairman of the membership committee for the forthcoming rejuvenation on January 10th gave an account of the work being done by this committee. Gate prizes in the form of an electric radiant grill, electric iron and electric toaster, were won by W. W. Hanscom, Paul Butte and B. M. Smarr, respectively. The attendance was nearly 100 and the meeting one of the most successful of the year.

STOCKTON JOVIAN REJUVENATION.

A rejuvenation of the Jovian Order was held at Stockton, Cal., on November 29th, under the joint auspices of A. E. Rowe, Statesman for San Francisco, and G. S. Pearce, Statesman for Sacramento. There was a large and enthusiastic attendance of Jovians from San Francisco and Sacramento to welcome and care for the nineteen newly made rejuvenated beings.

The rejuvenation was held in the Moose Hall, the work being done by the following team:

Jupiter, A. H. Halloran
Neptune, G. S. Pearce
Pluto, A. E. Rowe
Vulcan, F. D. Fagan
Hercules, L. A. Schloss
Mars, P. B. Hyde
Apollo, W. S. Hanbridge
Mercury, S. L. Hawkins
Avrenim, Murray Orrick.
Imps, J. A. Herr, G. D. Jones, W. C. Dolan, A. E. Commerford.

The rendition of the ritual was most excellent, especially considering the fact that only one member of the team had previously occupied the same position.

At the conclusion of the ceremonies an elaborate banquet was served at Madden's Cafe. Concluding the banquet, speeches were made by a large number of Jovians, including L. F. Youdall, who gave an address of welcome; A. H. Halloran, who spoke on the aims and purposes of the order; W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company who gave a straight-from-the-shoulder talk on Co-Operation; C. V. Schneider, president of the contractors' association; Noble Powell, one of the more prominent contractors; W. S. Hanbridge, secretary of the association and Statesmen Rowe and Pearce. A. E. Commerford acted as toastmaster.

The following were initiated and are now fully constituted members of the Jovian Order:

H. H. Adams, division manager, Oro Electric Corporation, Stockton.

J. H. Fagg, assistant superintendent, Pacific Gas & Electric Company, Stockton.

A. F. Flannagan, manager, Electrical Engineering & Supply Company, Stockton.

A. J. K. Gnekow, partner, Commeford & Gnekow, Stockton.

C. O. Gould, manager, Gould's Light House, Stockton.

A. S. Harrington, manager, New Business Department, Western States Gas & Electric Company, Stockton.

W. S. Heger Jr., engineer and contractor, Sacramento.

W. L. McDonell, superintendent construction, Electrical Supply Company, Sacramento.

Wm. A. Murphy, City Electrician, Stockton.

W. C. North, salesman, General Electric Company, San Francisco.

E. R. Pahntag, salesman, Dunham, Carrigan & Hayden Company, San Francisco.

J. A. Patzer, proprietor, Patzer's Electric Works, Stockton.

N. D. Powell, electrical contractor, Noble D. Powell Company, Stockton.

G. N. Somerville, electric salesman, Sterling Iron Works, Stockton.

J. O. Tobey, division superintendent, Pacific Gas & Electric Company, Sacramento.

G. W. Treinor, partner, Waltz & Treinor Electric Company, Stockton.

H. E. Waltz, manager, Waltz & Treinor Electric Company, Stockton.

F. G. Van Booskirk, H. W. Johns-Manville Company, Stockton.

L. F. Youdall, manager, Electric Machine Equipment Company, Stockton.

This rejuvenation is but the first of several which Statesman Rowe has planned for the near future. On January 10th he has scheduled a large rejuvenation to be held in San Francisco and he is bending every effort toward placing San Francisco at the head of the list and thus aid in bringing the annual convention to San Francisco in 1915.

TRADE NOTES.

NePage, McKenny & Company, 325 Yesler Way, Seattle, are rewiring the six-story Pacific building at Occidental and Yesler Way.

The W. H. Smith Electrical Engineering Company, Spalding building, Portland, has been awarded the contract for the electrical work in the Pittock building being erected in that city.

The Summerland Telephone Company, Limited, Summerland, B. C., has placed an order with the Kellogg Switchboard & Supply Company for a complete common battery system.

Evans-Dickson Company, electrical engineers and contractors, have secured the contract for electric work on the Lincoln Park high school at Tacoma, amounting to approximately $10,000. This calls for telephones, call bell wiring, light wiring, switchboards, etc.

The Wagner Electric Manufacturing Company, St. Louis, announces through its New York office, 30 Church street, that they have made arrangements with E. I. Van Doren, 343 River street, Troy, N. Y., to handle the sale of Wagner products in Troy and vicinity.

The switchboard for the Elwha power plant of the Olympic Power Company, Port Angeles, Washington, has been completed and nearly all of the apparatus has been delivered for the Hoods Canal and Bremerton substations. These were supplied by the Westinghouse Electric & Manufacturing Company.

The Allis-Chalmers Manufacturing Company has secured the Wheeler Lumber Company contract for the following electric motors required to operate its new lumber mill at Wheeler, Oregon; 2-2 h.p. squirrel cage motors for driving filing room machinery; 5-3 h.p. squirrel cage motors for driving swing up saws and filing room machinery; 2-5 h.p. squirrel cage motors for driving transfers; 10-7½ h.p. squirrel cage motors for driving transfers and lumber sorter; 1-10 h.p. squirrel cage motor for driving fuel conveyor; 1-20 h.p. squirrel cage motor for driving planing machine; 2-25 h.p. squirrel cage motors for driving fans and vertical resaw; 1-30 h.p. squirrel cage motor for driving planing mill machinery; 1-50 h.p. squirrel cage motor for driving planing mill machinery; 1-35 h.p. slip ring motor for driving unloader; 2-65 h.p. squirrel cage motors for driving planing machines; 1-75 h.p. squirrel cage motor for driving fan; 2-40 k.v.a. lighting transformers; 2-15 k.v.a. lighting transformers.

Oregon Society of Engineers.

The Board of Higher Curricula of the State of Oregon requested the Oregon Society of Engineers to file with them a brief covering the following points: First, what is an industrial or vocational engineer and what would the society regard as a fair preparation either through a course of study or practice or both. Second, a course of study at the minimum which the society would deem adequate under present conditions to fit a man for the professional degree of engineering, noting at what point in the course candidates for the several special degrees should begin to differentiate in their course and giving the course suitable for the several degrees.

The reason the request was made for the course to be put at its minimum was that the boy of limited means might not be required to pursue a course beyond just what was adequate, the thought being that the course must be ade-

quate in the interest of the public and the profession but must be started at its minimum in the interest of the poor boy.

In order to secure open discussion on the subject of Engineering Education, with special reference to the University of Oregon and the Oregon Agricultural College, the Oregon Society of Engineers held a meeting in Room A of the Multnomah Public Library Building, in Portland, Oregon, on Thursday evening, November 13th, at which time many ideas were expressed both in writing and verbally. Both colleges being well represented. Prior to this meeting, in order to obtain definite recommendations to forward the Board of Higher Curricula, President W. H. Graves of the Oregon Society of Engineers appointed Messrs. H. L. Vorse and F. D. Weber, as a committee to formulate a "tentative course" of study to be followed in order to thoroughly and properly equip a professional electrical engineer for the practice of his profession after graduation.

The two colleges in Oregon have different entrance requirements and have courses of study which vary quite materially, therefore the committee confined itself only to "recommendations" and a "tentative course," and not to the "specific changes" in the above-named colleges in order to improve the present courses of instruction. Also the committee appreciated the fact that the present funds available for engineering education, would also hamper the colleges if they should attempt to carry out immediately all the changes recommended.

The paper as presented at the meeting is as follows:

After due consideration and with the conviction, based on actual experience, that our University and College courses do not train students for the actual and practical needs of a professional electrical engineer—and not at all for a vocational engineer—your committee, in working for a tentative course for professional electrical engineers, begs to report as follows:

First: That the training of a vocational engineer should be left to the public trade school system and should not be a part of the university or college. Schools such as the Portland Trade School and the Lick School of Mechanical Arts, San Francisco, covering that ground in the proper form.

Second: Entrance requirements at both colleges, University of Oregon and Agricultural College should be uniform and require four years High School course, and upon graduation, a uniform degree should be given at both institutions for equivalent courses.

Third: Under graduate courses should be for four years.

Fourth: All mathematics up to calculus to be taught in the High Schools or preparatory schools. Omitting long courses in plane and solid geometry and substitute short courses in geometrical forms and take up the study of trigonometry directly. Abstract mathematics should be avoided. All problems should have practical application all the time and be applied to other subjects besides mathematics such as physics, hydraulics, surveying, etc. We feel that mathematics is taught at the present time in historical sequence and not to produce the best working knowledge for the engineer.

Fifth: Mechanical drawing—instrumental in its nature—and free-hand lettering, etc., should be taught in the High School. The drawing subject to be applied to practical subjects such as bolts and screw heads, etc.

Sixth: Modern languages if taken in the High Schools should be elective and extend over four years and efforts should be concentrated on one language.

Seventh: We would recommend a thorough course in commercial law, business practice and accounting, to be taught in the Preparatory or High Schools.

Eighth: Within the University and College, there should be efforts made to eliminate the practice of inbreeding of instructors and professors who have no practical experience in the subject they endeavor to impart to the prospective engineers.

Ninth: We would recommend for an advance degree work in electrical engineering—two years of extended study divided between the parent institution and travel and study at one or more of the leading institutions of this and in foreign countries.

In the tentative course submitted to the Society we have only been able to outline same, the finer details of application will necessitate years of adjustment.

Tentative Course.

Undergraduate Year.

	Hours. 1st term.	2d term.
Mathematics: Calculus limited to that actually used by the engineer and its application to engineering	5	5
Mechanical Drawing: Elements of machine construction. Laboratory course	6	6
General Chemistry: Lecture course	2	2
Wood Work: Laboratory	3	
Pattern-making: Laboratory course		3
Machinery: Assembly and adjustment of simple machines. Laboratory and lecture	6	6
Physics: Lecture	2	2
Hygiene: Gymnasium	1	1
Elect. Courses.		

Sophomore Year.	Hours. 1st Term.	2d Term.
Mathematics: Problems in calculus as applied to engineering	2	2
The Elements of Complex Quantities: Its application to electrical engineering	2	2
Business Correspondence: As used by the engineer	1	1
Mechanical Drawing: Installation layouts, foundations, etc.	6	6
Machine Shop Practice	3	3
Machinery Assembly and Adjustments: Extended course	6	6
Wiring: Elementary work details of electrical trade fittings, outside construction, including pole lines in the underground construction. Laboratory and lecture	3	
Inside wiring—Laboratory and lecture		3
Life and fire hazard simple wiring calculation. Underwriters' rules. Lecture	1	1
Personal Hygiene: Lecture and gymnasium	1	1
Elective Courses.		

Junior Year.	Hours. 1st Term.	2d Term.
Mathematics: Elements of harmonic motion, Lecture.	1	1
Electrical Engineering: Application of the complex quantities to the solution of problems involving inductance and capacity. Lecture	3	3
Mechanical Drawing: With special reference to the application of electrical machinery in the Industries supplemented by lectures	6	6
Electrical Machinery: Assembly and testing of electrical machinery and equipments. Repair and construction of parts, etc.	6	6
Electrical Measuring Devices: Lecture	1	1
Engineering Law: Contracts, incorporation, etc. Lecture	2	2
Strength of Materials: Principles and application to practical problems, including steel and concrete construction and footings for foundations. Lecture	3	3
Hydraulics: Lecture	2	2
Plane Surveying: Lecture and field work	3	3
Elective Courses.		

Senior Year.	Hours. 1st Term.	2d Term.
Electrical Engineering: The theory of the design of dynamo electric machinery motors, transformers, rotary and stationary, etc.	3	3
Mechanical Drawing: Details laying out a complete installation	6	6
Electric Machinery: Testing. Laboratory	3	3
Cost data: Calculation of the cost of complete installation. Valuations of properties. Writing of specifications and contracts. Lecture course	5	5
Thermo Dynamics: Lecture	2	2
Electrical Engineering: Distribution systems, application of power to same, and the various commercial utilizations of power, project work and estimates. Lecture course	3	3
Hydraulic Engineering: The location of reservoirs. Calculation of available power. Estimating watershed areas. Run-off data. Gauging of streams, etc.	3	3
Electrical Courses.		

NEWS NOTES

INCORPORATIONS.

WILLAPA, WASH.—Willapa Valley Telephone Company, $5000, by E. W. Lilly, V. Monohon, C. H. Clapshaw, et al.

FRESNO, CAL.—Fowler Gas Company, $50,000, shares $1 each, subscribed $50, by W. S. Ricketts, J. R. Lovely et al.

RICHLAND, WASH.—Richland Valley farmers have organized a country telephone system called Yakima & Columbia River Telephone Company. E. E. Floyd, president; J. R. Gardener, vice-president; Wm. Read, secretary.

OLYMPIA, WASH.—Articles of incorporation for the Tacoma Transit Company, capitalized at $30,000, have been filed with the secretary of state. The incorporators are J. Grant Hinkle, assistant secretary of state, and Geo. Everett, accountant in the office of Governor Lister.

BOISE, IHADO.—The Swan Creek Electric Power Company has filed articles of incorporation. The principal place of business being Swan Creek, Utah. Capital is $20,000, and the incorporators B. E. Slausser, Salt Lake City, Utah; Ola Transtrum, E. M. Pugmire and Chester Transtrum of St. Charles, Idaho, and Ezra J. Howell of Fish Haven, Idaho.

ILLUMINATION.

MIDVALE, IDAHO.—The Adams County Light & Power Company has petitioned for a light and power plant.

MYTON, UTAH.—R. E. Maxwell has started the excavation for the power plant to be erected by the Myton Electric Company at this place, and the same will now be rushed to completion.

EUREKA, CAL.—The city council has renewed the contract with the Western States Gas & Electric Company for street lighting. The contract specifies 203 or more arc lamps at $60 each per year.

KERRISDALE, POINT GREY, B. C.—Kerrisdale Ratepayers' Association is advocating the establishment of a municipal light and power plant with funds to be raised by the issue of baby bonds.

TACOMA, WASH.—A resolution has been passed providing for the installation of a street lighting system, consisting of metal standards with single globe lamps on each. Objections will be heard December 8th.

NELSON, B. C.—The property owners of Nelson have voted to purchase for $50,000 the Nelson Coke & Gas Company's system. This city now owns its own power plant, waterworks, gas system and street-making plant, and is negotiating for the street railway system.

NATIONAL CITY, CAL.—The Board of Trustees of National City has awarded a contract to the San Diego Consolidated Gas & Electric Company for installing lights and supplying current to 116 lights ot $1.75 per light per month. The contract becomes effective December 15th and covers a period of five years.

EUGENE, ORE.—Over $10,000 to be spent early next spring for the gas main extensions, is outlined in the program for the gas department of the Oregon Power Company for next year, as announced by Superintendent A P. Tillis. Most of the work outlined is the laying of heavy mains ahead of the paving that is expected to be done next year.

VANCOUVER, B. C.—The Vancouver city council has passed a resolution favoring the establishment of a municipal gas plant. The city engineer's estimate is that a plant could be established at an initial cost of $250,000, enabling gas to be sold at $1.16 per thousand, while the minimum price for gas quoted by applicants for a franchise was $1.40.

ASTORIA, ORE.—Engineer Bergsvik reported on the proposition of constructing a municipal power and light plant on the commission's property on the Nehalem River. The engineer stated that a plant could be installed at a cost of $400,000 which would develop double the energy now required to furnish light and power for the city.

STOCKTON, CAL.—The Oro Corporation has filed an application with the commission stating that the city of Stockton is about to invite bids for lighting the streets, municipal buildings and other public places, and that the Oro Electric Corporation desires to submit its bid. Last December the city of Stockton granted to the company a general franchise to operate an electric distribution system within the city. The present application asks that the company be permitted to exercise the privileges granted to it in this franchise in so far as would be necessary to supply electric current to the municipality for the purpose of lighting streets, municipal buildings and other public places.

BOISE, IDAHO.—Competition has developed in southern Idaho between two of the large electric lighting and power companies, the Great Shoshone and Twin Falls Power Company and the Idaho Power & Light Company, formerly the Beaver River Power Company. The former company is seeking to block the latter from entering the Twin Falls district to supply electrical energy, and has applied to the public utilities commission to refuse to grant the Idaho Power Company a certificate of public necessity to extend its lines into the territory referred to. Both companies have large investments in southern Idaho. The Great Shoshone Company is controlled by the Kuhn interests of Pittsburgh. The principal plant is at the Great Shoshone Falls. Its other plants are in course of construction at the Upper and Lower Salmon Falls. The company supplies not only Twin Falls, but Wendell, Jerome, Gooding and Glens Ferry. The Idaho Power & Light Company is controlled by the Nunns. At present it serves Boise and the Boise Valley and a few other Idaho cities with its principal power plant on the Malad River.

TRANSMISSION.

COACHELLA VALLEY, CAL.—The Coachella Valley Ice & Electric Company has applied to the commission for permission to issue its first mortgage 6 per cent bonds of the aggregate face value of $300,000, the proceeds of which are to be devoted to the construction of electric distribution lines in and around Coachella and Imperial Valleys. The Holton Power Company has asked permission to guarantee these bonds and the interest thereon of the Coachella Valley Ice & Electric Company.

OAKLAND, CAL.—The Great Western Power Company has applied to the commission for a certificate of public convenience and necessity to distribute electricity inside the city of Oakland. The application states that the Great Western has heretofore, under franchises granted in 1909, been selling electricity in a portion of Oakland. It now asks for authority to extend its lines and poles, and to construct the necessary equipment to make a general distribution of electricity throughout the city of Oakland.

LOS ANGELES, CAL.—Geo. L. Hoxie of New York, C. L. Cory of Berkeley, and C. W. Koiner of Pasadena, electrical experts who have been investigating the financial side of the municipal electrical distribution system, have filed a report with the city council. The report's approximate

estimates are $5,000,000 for distribution system installation, exclusive of railways; annual cost of operating, including interest, depreciation and sinking fund, $1,850,000; yearly earnings, $2,250,000, with net profits to city, $600,000.

EUGENE, ORE.—The completion of preliminary surveys for the development of 45,000 horsepower within the next five years at Clear Lake, in the Cascade Mountains, 75 miles east of Eugene, has been announced by Geo. S. Enmonston, hydraulic engineer of the Oregon Electric Railroad. The total cost of the installation will be upwards of $5,000,000. Construction of the first unit is to begin about June, 1914. It is proposed to tunnel through the walls of the lake and carry the water in a 10 ft. conduit, a mile and a half under a 500 ft. head to the first power plant.

SAN FRANCISCO, CAL.—The Lake Spaulding dam of the Pacific Gas & Electric Company, in Placer county, is completed. The dam will hold 20,000,000 gallons of water. The waters controlled by this dam will be used in developing electricity six times before they are turned loose on the 75,000 acres of deciduous fruit lands in Placer county for irrigation purposes. The site of Lake Spaulding dam was acquired by the present owners in 1905, and surveys were made the following year. Construction started in July, 1912, and the first concrete was placed in the river bottom November 15th of that year. The last concrete was placed at an elevation of 242 ft., November 17, 1913. The present height of the dam is 242 ft. above the river bed, but work is to commence soon on an addition which will bring the height of the structure to 320 ft., the highest in the world. The project thus far has cost $5,000,000; the completed work will cost $15,000,000.

TRANSPORTATION.

PORTLAND, ORE.—A franchise has been granted the Portland & Oregon City Electric Railway Company to operate cars on streets of the city. Construction work will start immediately.

CLARKSTON, WASH.—A movement to construct between three and four miles of street car line to serve Clarkston and Vineland has been launched at a meeting of the chamber of commerce.

VICTORIA, B. C.—The mayor of Victoria advocates, in view of the recent rise in street car fares by the B. C. Electric Railway, that a Greater Victoria be organized with a view to taking over the system as a public utility.

NORTH YAKIMA, WASH.—Superintendent Drake, Yakima Valley Transportation Company, has asked stockholders of the company for money to make three miles extension of suburban line into Wide Hollow to tap the Tieton district.

PORTLAND, ORE.—The franchise granting to Geo. F. Heusner the right to construct on electric railway line from the Kenton district to the westside business section, has passed the city council. The estimated cost of the line is $350,000.

CENTRALIA, WASH.—The Lewis County Commissioners have granted a franchise to the Washington-Oregon corporation to operate a line from the Galvin station near the fair grounds on South street to the old Union Pacific grade, and thence north to the city limits.

TACOMA, WASH.—December 30th has been set for the date for the special election for the purpose of voting $87,000 worth of bonds to construct and maintain a municipal street car line across the Eleventh street bridge to the manufacturing district on the tide flats.

MILL VALLEY, CAL.—An application has been made to the board of trustees by W. W. Hicks for a street railroad franchise upon certain streets in the town of Mill Valley. Sealed bids will be received by the board of trustees up to January 13, 1914, for the sale of the franchise to the highest bidder.

TACOMA, WASH.—The council has enlarged on its municipal street car program and will submit a proposal on December 30th to get authority to build to all populous points in the city. Only one or possibly two bond issues will be asked for as follows: $87,000 for tide flats line and $63,000 for the Sixth avenue extension.

RIVERSIDE, CAL.—The Riverside County Supervisors and the property owners of that county have made possible, the immediate construction of the Riverside-Corona extension of the Pacific Electric system. The railway company now has a deeded right-of-way from the Riverside City limits to Corona. The Riverside-San Bernardino electrification has been practically completed, but regular schedule has not been established, pending the completion of the San Bernardino-Los Angeles extension.

SAN FRANCISCO, CAL.—The public utilities committee of the supervisors has decided that the city shall take over the Union street line on December 11, when the franchise of the Presidio & Ferries Railroad Company expires, and that the road shall be run as a part of the municipal railway system. The matter of fixing the value of the property and paying for it are regarded as details which can be settled afterward. The intention is to have the operation of the road continue as usual until the city officials get ready to reconstruct it.

OAKLAND, CAL.—A deed of trust has been filed for the Oakland, Antioch & Eastern Railway making the Union Trust Company of San Francisco trustee for a bond issue of $5,000,000. The deed of trust conveys to the trustee all the property of the company, including "right of way through Contra Costa and San Joaquin counties into the city of Stockton, which the corporation now holds or which it may hereafter acquire." The filing of the document has given rise to an unconfirmed rumor to the effect that the Oakland, Antioch & Eastern is perfecting plans for entering Stockton.

SAN FRANCISCO, CAL.—The United Railroads has made arrangements with E. H. Rollins & Sons for the extension for a period of two years of $1,800,000 Market Street Cable Railway 6 per cent bonds, a former extension on which will expire December 15th. Four coupons will be delivered with the bonds and the United Railroads obligates itself to pay the interest at 6 per cent during the extended period, The local bond house will buy all the bonds of this issue offered on December 15th and, after providing for the new extension, offer them to investors at 99½ and interest.

SAN FRANCISCO, CAL.—A rapid transit scheme, involving the construction of an elevated railroad from the ferry and railway lines to outlying districts, has been filed with the supervisors by the Twin Peaks Tunnel Company Property Owners' Association. A diagram, showing the proposed routes, has been prepared by the association's engineer, John M. Punnett. As the proposition includes the joint use by the city of the tracks of the electric line to be constructed by the Southern Pacific on its steam railroad right of way through the Mission and also of the Ocean Shore Railroad Company's tracks, the association suggested that the board create a commission to consider this scheme, consisting of the engineers of the Southern Pacific, Ocean Shore and United Railroads and the city engineer.

BOISE, IDAHO.—The public utilities commission of this state has refused to issue a certificate of public convenience and necessity to the Ashton & St. Anthony Power Company to operate in the city of St. Anthony or in the Egin bench country, which is tributary, through a ruling rendered today. The company is permitted, however, to operate in the towns of Marysville and Ashton in Fremont county and in the territory adjacent to these towns, as franchises had already been secured there. The Utah Power & Light Company, with headquarters in Salt Lake City, which operates in the same territory, was the principal opponent of the application.